Train the trainer
TEACH CVI project

Dublin, Ireland
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Chapter I

Els Ortibus
Katholieke Universiteit Leuven, Belgium

http://www.teachcvi.net

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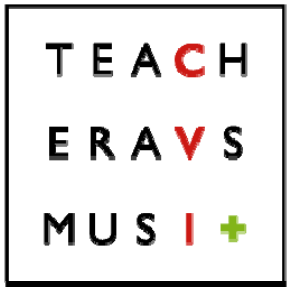
Overview chapter 1



- General information about CVI
- Guidelines
- Multidisciplinary team
- Screening tool for detection of children with CVI
- CVI assessment
  - Ophthalmological assessment
  - Neuropsychological/psychological assessment
  - Assessment of visual functions and functional vision
- Terminology

General information about CVI

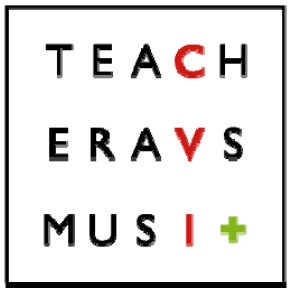
General information about CVI

- So far there is no ICD-10 code for the diagnosis of CVI

- Most often following ICD-10 codes are used:
  - H47.6: disorders of visual cortex
  - H47.7: unspecified disorder of visual pathways
  - H53.8: other visual disturbances

- For your convenience, we refer to the CVI diagnosis although this isn't specified in ICD-10

General information about CVI



o Definition

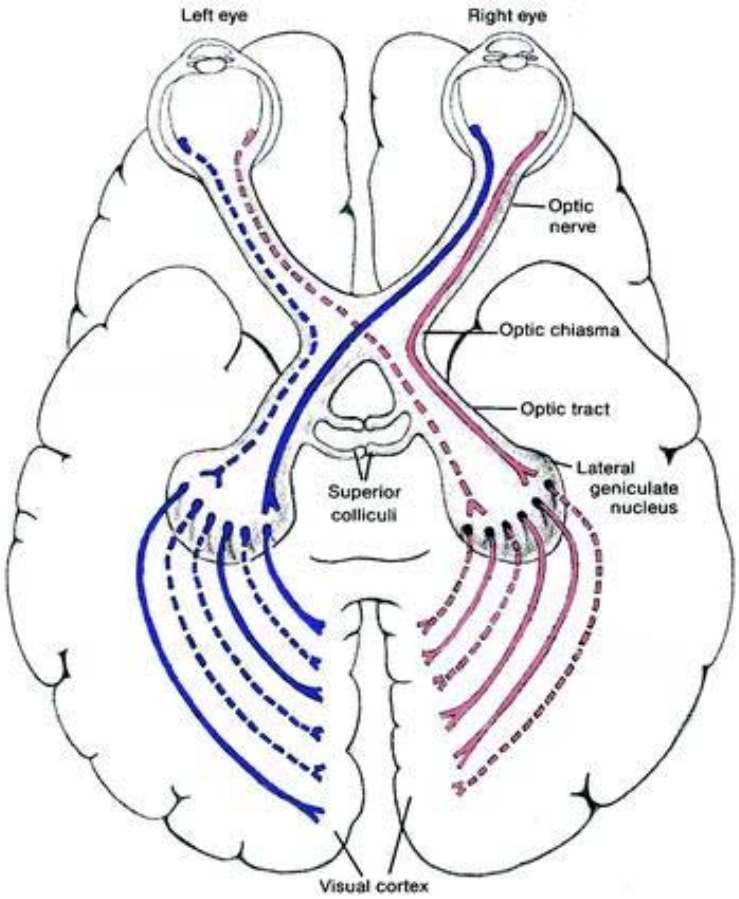
- A term used to describe visual impairment due to injury to the visual pathways and centres of the brain

- CVI is not caused by a disorder of the eyes, but the visual systems of the brain do not consistently understand or interpret what the eyes see. Thus, processing of visual information is impaired.

- The degree of visual impairment depends on the severity and location of the neurological damage as well as time of onset

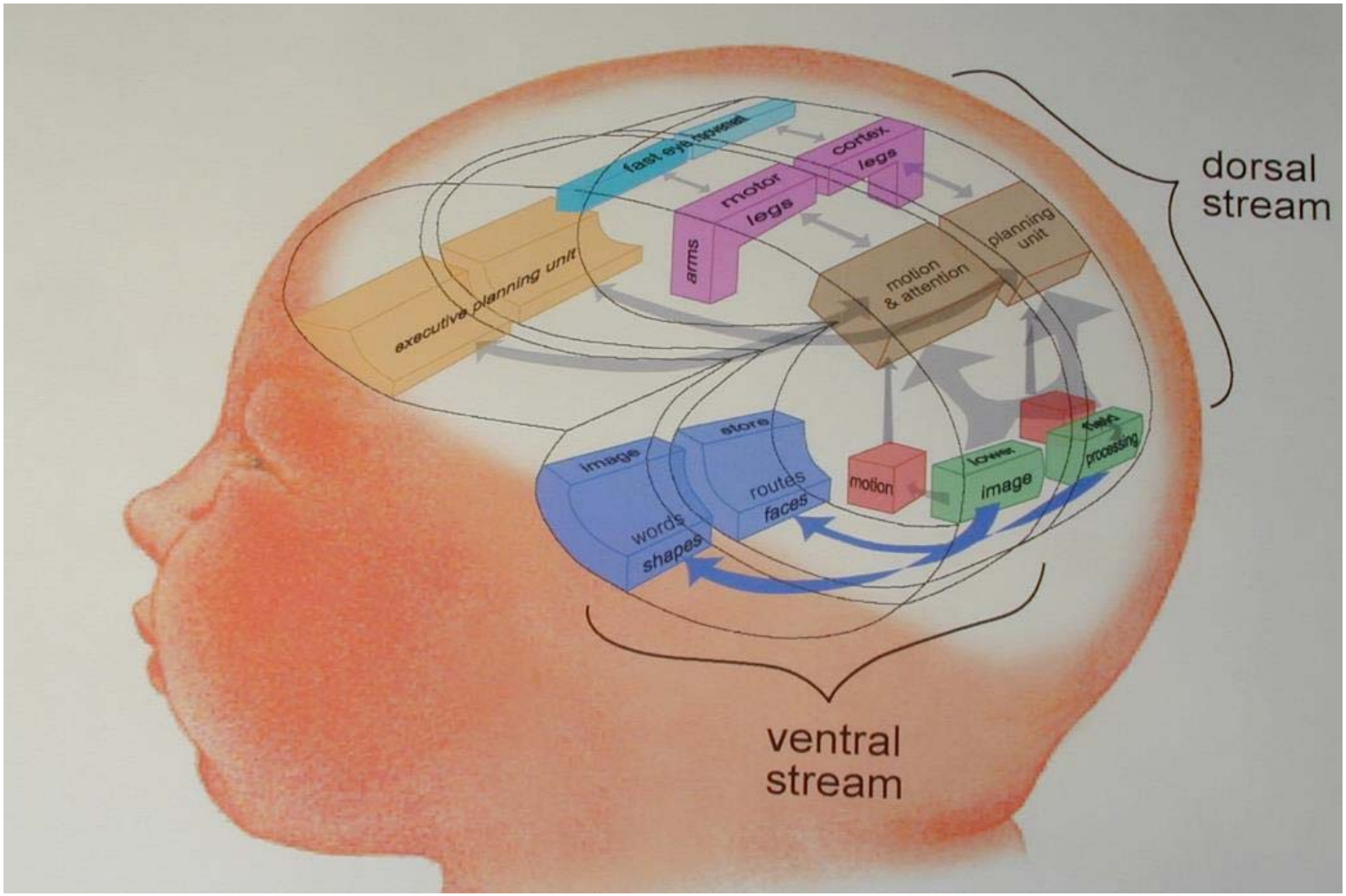
- Visual outcomes can range from total blindness to mild disturbances in visual perception and frequently these children can also present with neurological disorders such as cerebral palsy, epilepsy and learning disability

General information about CVI



a. **Peripheral segment**: Sensory receptor – Eye and optic nerve
b. **Intermediary segment**: Neural pathways responsible for the transfer of information – Optic tract, optic chiasma and optic radiations
c. **Central area**: Part of the brain involved with the processing of information – Visual cortex

General information about CVI



Adapted from "*Cognitive vision, its disorders and differential diagnosis in adults and children: knowing where and what things are*", by G. N. Dutton, 2003, *Eye, 17*(3), p. 291.

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Guidelines

Guidelines

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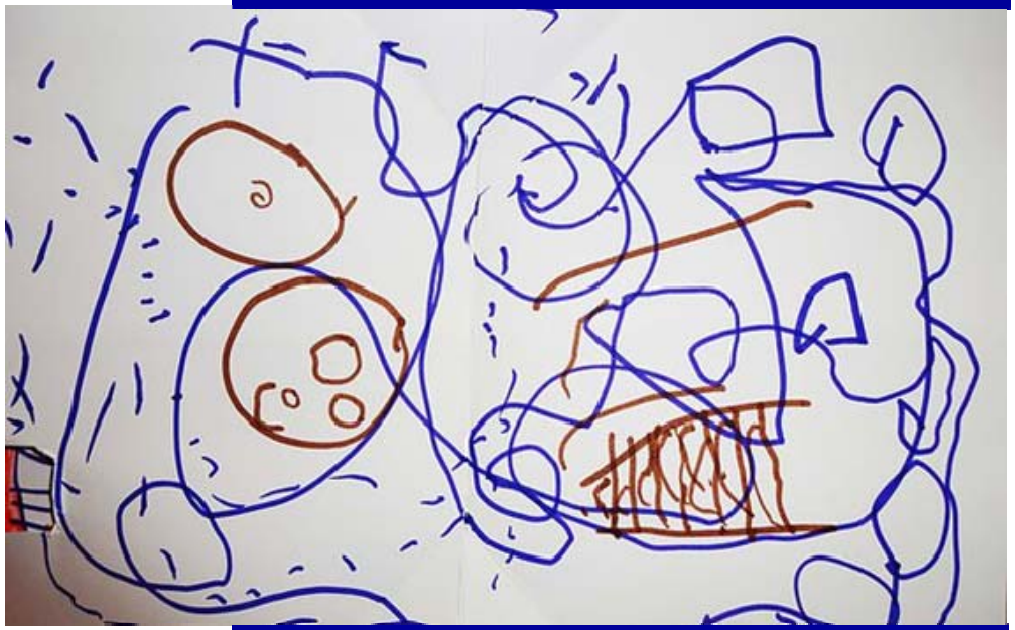
Cerebral Visual Impairment

Guidelines for health care professionals and educational professionals



"My home: stairs, people and windows"
Drawing by S.H., a five year old girl with CVI.

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Guidelines

- Leaflet for health care and educational professionals who are working with children at risk for CVI

- Short overview of the TeachCVI project

- Guidance is provided on:
  - What is CVI?
  - Risk factors
  - Signs and symptoms
  - Consequences
  - Assessment
  - Access to literacy
  - Treatment / Intervention
  - Teaching strategies

Guidelines

- For clinical purposes, children with ***CVI*** can be grouped into three categories:
  - Children with profound visual impairment due to ***CVI***, many of whom have additional disabilities
  - Children with ***CVI*** who have better functional visual abilities and some cognitive and motor challenges
  - Children with ***CVI*** who have sufficient vision, that allows them to work at or near the expected academic level for their age group. Some can have additional motor disorders

- ***CVI*** is not an indicator of the child´s cognitive ability but it may have an adverse impact on the child´s development

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Multidisciplinary team

Multidisciplinary team

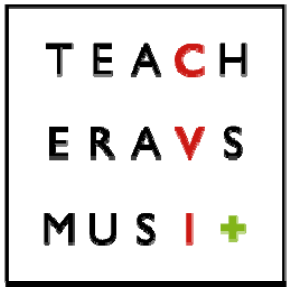
- The diagnosis of/intervention for Cerebral Visual Impairment (CVI) requires the participation of a multidisciplinary team

- A multidisciplinary team should include:
  - Pediatric neurologist / pediatrician
  - Ophthalmologist / orthoptist / optometrist
  - (Neuro)psychologist
  - Low vision therapist / special education teacher

  And might also include:
  - Physiotherapist
  - Occupational therapist
  - Speech language therapist
  - Social worker / social care worker

Screening lists

Screening lists



- First step to decide when to refer children with a suspicion of CVI to specialized centers for further assessment

- These are screening tools, not diagnostic tools!

- Structure
  - General questions (e.g. medical, developmental, and visual problems)
  - Actual screening list
  - Space for further comments

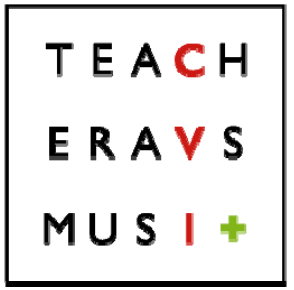
Screening lists: guidance for use

- Three screening lists and scoring documents:
  - Screening list CVI 1: children with a motor disability who are non-ambulant
  - Screening list CVI 2: children with a developmental age between two and six years old
  - Screening list CVI 3: children with a developmental age between six and twelve years old

- Parents, teachers, healthcare professionals and other interested persons fill in the screening list

- Healthcare professionals score and review the screening tools

Screening lists: guidance for use



- At the moment there is no scientific research carried out on these screening lists. The scoring is based on previous research and professional experience

- The answers that are indicative for CVI are marked bold for each question and specific screeners are indicated in each list:
  - Scoring list 1
  - Scoring list 2
  - Scoring list 3

- Healthcare professionals need to count the number of bold answers and should also check whether or not screeners are marked

Screening lists: guidance for use

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1 = Never	2 = Occasionally	3 = Frequently	4 = Always
1. Makes eye contact.			**1** **2** 3 4
2. Has difficulties with looking at objects.			1 2 **3** **4**
3. Has difficulties with looking at people.			1 2 **3** **4**
4. Stares at light sources (e.g. lights or windows).			1 2 **3** **4**
5. Notices objects positioned at waist level or below.			**1** **2** 3 4
6. Use of vision can fluctuate.			1 2 **3** **4**
7. Smiles in response to you smiling at him/her.			**1** **2** 3 4
8. Recognizes familiar persons only when they speak.			1 2 **3** **4**
9. Prefers certain colours over others.			1 2 **3** **4**
10. Does not recognise common objects.			1 2 **3** **4**
11. Does not recognise common pictures/images.			1 2 **3** **4**
12. Can find a favourite toy easily when it is amongst other toys.			**1** **2** 3 4

Screening lists

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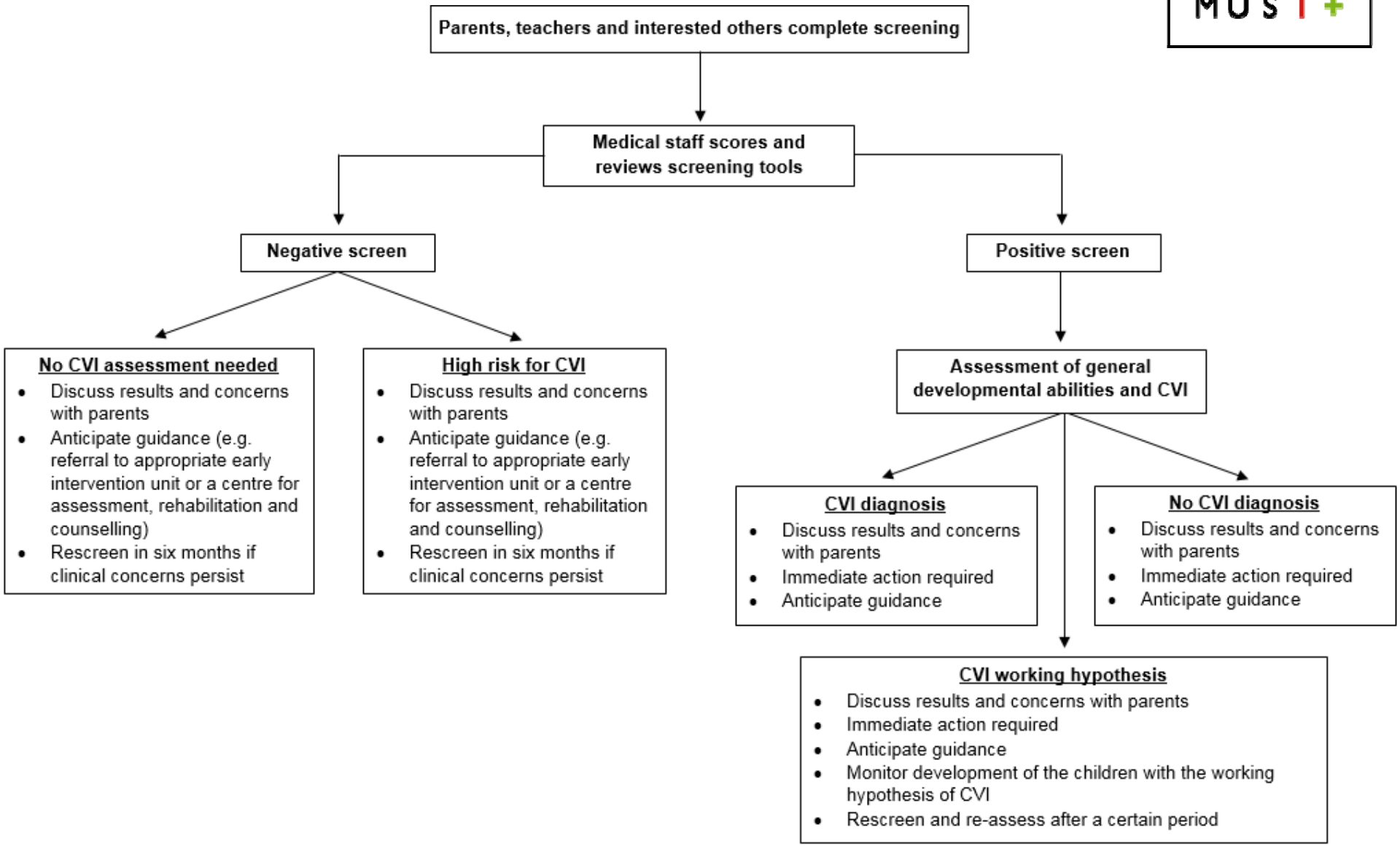

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CVI assessment

CVI assessment

- Ophthalmological assessment
- Neuropsychological assessment
- Functional vision and visual function assessment

Ophthalmological assessment

Ophthalmological assessment

- **Overview** - How is vision evaluated?
  - Medical history is taken from the parents and the patient
  - The ophthalmologist's first general assessment: evaluation and examination of the patient and his/her eyes
  - Assessing vision:
    - Visual function testing (e.g. visual acuity, visual field, colour vision, contrast vision, binocular vision and visual function)
    - Additional testing (e.g. electrophysiological testing or imaging procedures) to help with diagnosing and evaluating the patient and his/her eye-sight
  - Children with a suspicion of CVI

Ophthalmological assessment

- **History**
  - Mother's health before and during pregnancy
  - Pregnancy
    - Duration
    - Birth weight
  - Pregnancy and breast feeding:
    - Toxic or infectious agents
    - Use of medication
    - Fever or rash
  - Family history
  - The child's health and development

Ophthalmological assessment

- **The ophthalmologists first general assessment**
  - The first appearance of the child. Depending on the age of the child – what to expect.
  - Observations during the examination:
    - Eye contact, eye control and eye movements (e.g. fixation, saccades, smooth pursuit movements and visually guided grasping)
    - Is the child interested in it's surroundings?
    - Do they notice small objects around them?
    - Demeanor, coordination, physical habitus and head posture
    - General appearance of the eyes: strabismus, nystagmus, eye motility, size, asymmetry and surface anatomy of the eyes and the surrounding tissue

Ophthalmological assessment

- **Assessing vision – Overview**
  - Specific testing: methods depending age, health and development of the child
  - Position of the eyes:
    - Observation of deviations
    - Evaluation of size and angle
    - Corneal light reflex
    - Cover/uncover test (for those who can maintain fixation)
    - Fixation behaviour
    - Observation of eye movements

Ophthalmological assessment

- **Assessing vision – Specific testing**
  - Fixation behaviour

Ophthalmological assessment

- **Assessing vision – Specific testing**
  - Eye movements – Movements are described as:
    - Elevations: Pupil directed upwards
    - Depression: Pupil directed downwards
    - Abduction: Pupil directed laterally
    - Adduction: Pupil directed medially
    - Extorsion: Top of eye rotating away from the nose
    - Intorsion: Top of eye rotating towards the nose
  - The child's ability to track/follow an object is tested at close range, for one eye and both eyes

Ophthalmological assessment

- **Assessing vision – Specific testing**
  - Stereovision – Titmus stereotest
    - Contour stereotest
    - The most well-known example is the Titmus Fly Stereotest where a picture of a fly is displayed with disparities on the edges. The patient uses 3D glasses to look at the picture and determine whether a 3D figure can be seen

Ophthalmological assessment

- **Assessing vision – Specific testing**
  - Visual acuity – **Preferential looking**
    - Forced choice preferential looking tests:

Teller cards

Lea gratings

Ophthalmological assessment

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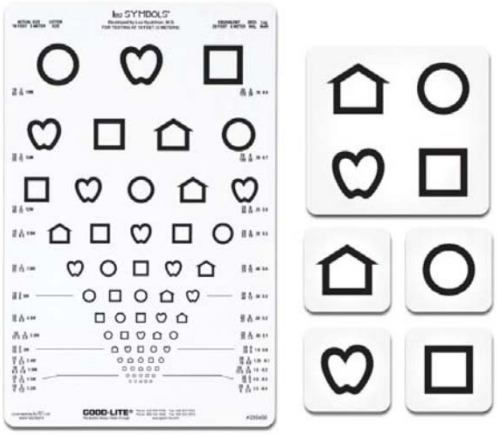
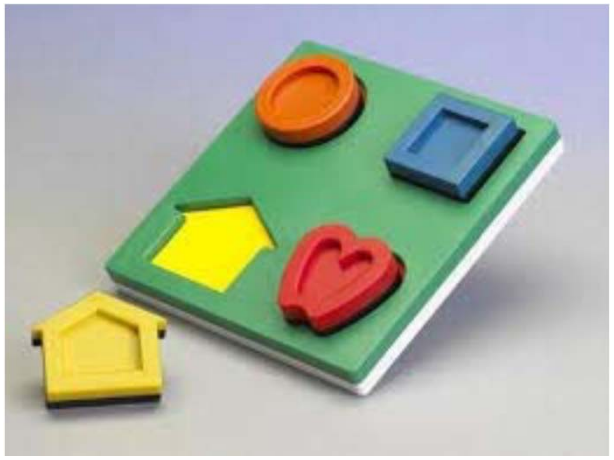
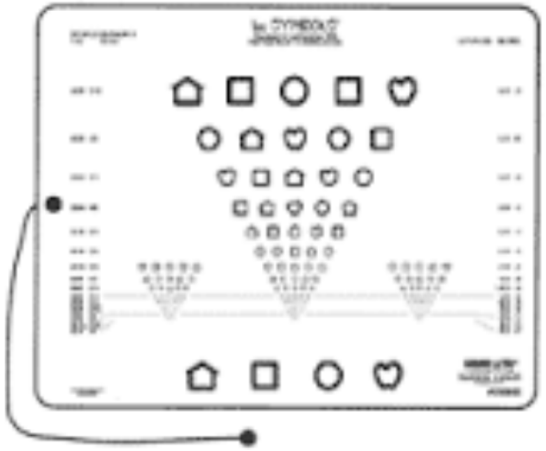
- **Assessing vision – Specific testing**
  - Visual acuity – **Optotype testing**



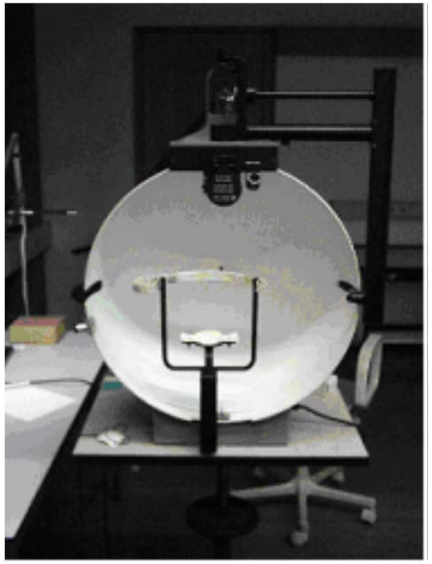




Lea symbols

Ophthalmological assessment

- **Assessing vision – Specific testing**
  - Visual field



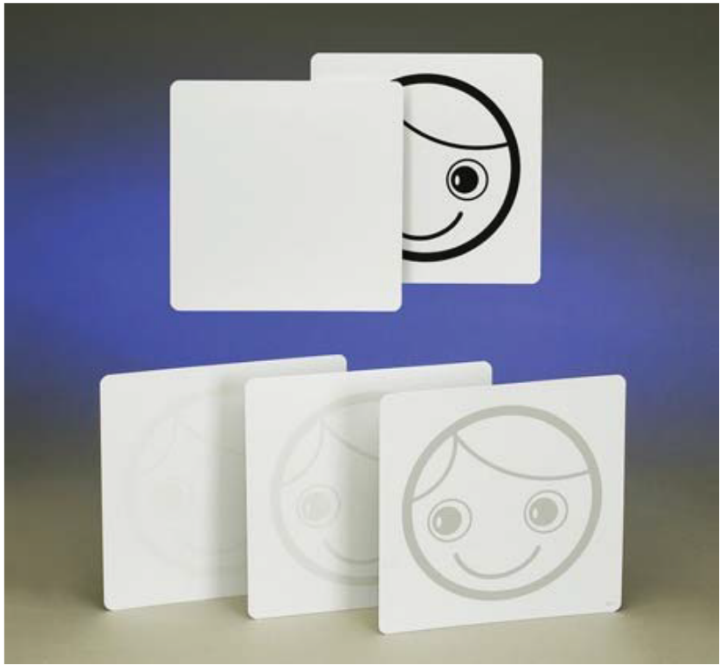
Goldmann

Confrontation testing

Ophthalmological assessment

- **Assessing vision – Specific testing**
  - Contrast sensitivity

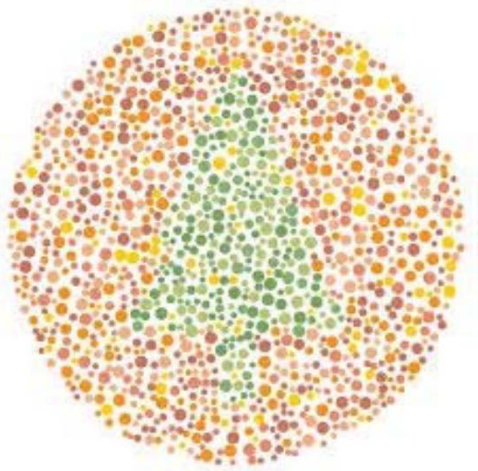
Pelli Robson – Contrast Sensitivity Chart

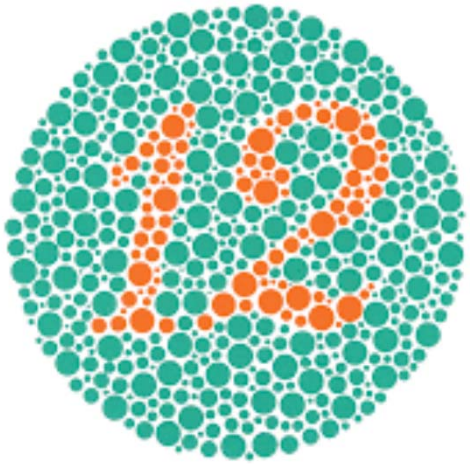


Lea Hyvarinen – Heiding Heidi Low Contrast Test

Ophthalmological assessment

- **Assessing vision – Specific testing**
  - Colour vision

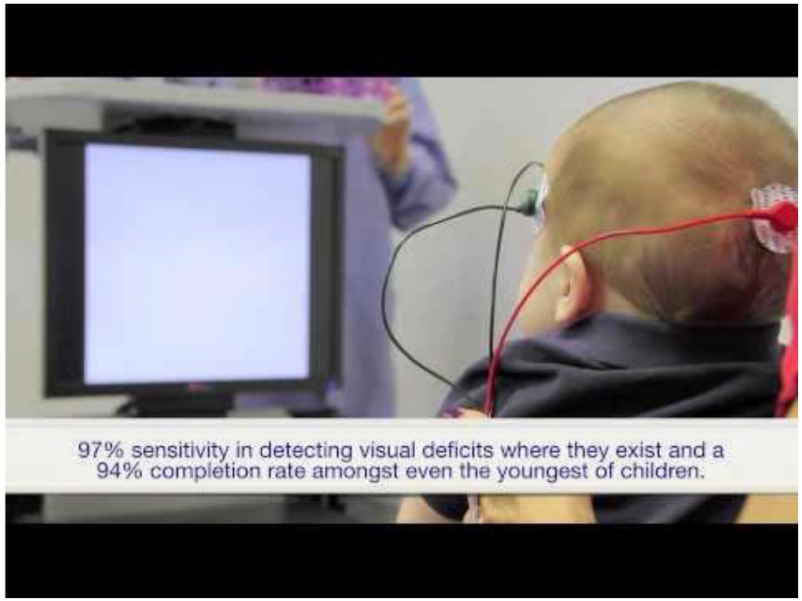




Ishihara Color Test

Ophthalmological assessment

- **Assessing vision – Additional testing**
  - Visually Evoked Potential (VEP)



Ophthalmological assessment

- **Children with a suspicion of CVI**
  - Evaluation of each child
    - The evaluation of each child is different
    - Which methods are chosen for vision assessment depends on the problems at hand as well on the child itself

Neuropsychological assessment

Neuropsychological assessment

- The physiotherapist assesses the motor skills, and more specific the visuo-motor skills.

- The (neuro)psychologist / educationalist is responsible for:
  - The (neuro)psychological assessment
  - Observations of free play or in a classroom
  - Interactions with caregivers
  - Interviews with parents or caregivers

- There are various assessments and observational tools available that can be used as part of the diagnosis of CVI. This list is intended to be comprehensive but should not be taken to be exhaustive. These tools are currently used by professionals in the countries participating in the TEACH CVI project.

  Note: it is always necessary to assess the cognitive abilities of the child as well!

Neuropsychological assessment

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- **Overview – Attention / neglect**

< 3y	3y – 6y	6y – 12y	12y – 18y	> 18y
• BSID-II • Bayley-III • G.CVI.Tods	• NEPSY-II • Visual search task	• NEPSY-II • TEA-Ch • Cookie Theft Picture • CDT • Line bisection task	• NEPSY-II • TEA-Ch • Cookie Theft Picture • CDT • Line bisection task	• UFOV • Cookie Theft Picture • Bells test • CDT • Line bisection task • BIT

Neuropsychological assessment

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o Overview – Lines / Visuospatial processing

< 3y	3y – 6y	6y – 12y	12y – 18y	> 18y
• BSID-II • PDMS-2	• Preschool JLO • DTVP-2 • MVPT-3 • Beery VMI • TVPS-3 • EFT • PVMIA • NEPSY-II • M-ABC-II • WRAVMA • Bender-Gestalt II • PDMS-2	• JLO • DTVP-2 • MVPT-3 • Beery VMI •TVPS-3 • EFT • RCFT • NEPSY-II • M-ABC-II • WRAVMA • BVRT • Bender-Gestalt II	• JLO • DTVP-A • MVPT-3 • Beery VMI • TVPS-3 • EFT • RCFT • NEPSY-II • M-ABC-II • WRAVMA • BVRT • Bender-Gestalt II	• JLO • DTVP-A • MVPT-3 • MVPT-V • Beery VMI • EFT • RCFT • BVRT • VOSP • L-Post • Bender-Gestalt II

Neuropsychological assessment

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- **Overview – Colour**

< 3y	3y – 6y	6y – 12y	12y – 18y	> 18y
• Ishihara	• Ishihara • AOHRR • PVMIA	• Ishihara • AOHRR	• Ishihara • AOHRR	• Ishihara • AOHRR

Neuropsychological assessment

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- **Overview – Objects**

< 3y	3y – 6y	6y – 12y	12y – 18y	> 18y
• BSID-II • Bayley-III • G.CVI.Tods	• VOT • CVIT 3-6 • L94	• VOT	• VOT	• VOT • BORB • Poppelreuter-Ghent-s Overlapping Figures Test • VOSP • L-Post

Neuropsychological assessment

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- **Overview – Faces**

< 3y	3y – 6y	6y – 12y	12y – 18y	> 18y
• BSID-II • Bayley-III	• NEPSY-II • CMS	• NEPSY-II • CMS • BFRT	• NEPSY-II • CMS • BFRT • WMS-IV	• Mooney closure faces test • BFRT • WMS-IV

Neuropsychological assessment

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- **Overview – Memory**

< 3y	3y – 6y	6y – 12y	12y – 18y	> 18y
	• NEPSY-II • CMS • TVPS-3	• NEPSY-II • CMS • TVPS-3 • RCFT • CMVT • BVRT	• NEPSY-II • CMS • TVPS-3 • RCFT • BVRT • WMS-IV • CMVT	• CMVT • BVMT-R • WMS-IV • RCFT • BVRT

Neuropsychological assessment

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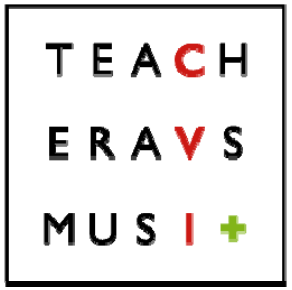
- **Overview – Motion**

< 3y	3y – 6y	6y – 12y	12y – 18y	> 18y
• G.CVI.Tods	• CVIT 3-6 • Biological motion • Motion speed • Form from motion • Motion Coherence			• L-Post

Visual function and functional vision assessment

Visual function and functional vision assessment – Framework



	Visual Functions *How the visual system functions*	Functional Vision *How the person functions*
Examples	*Visual acuity, visual field, contrast, visual adaptation, color vision etc.*	*Orientation and Mobility, Daily Living Skills, Communication, Sustained near activities*
Measured	*For each eye separately*	*For the person as a whole*
Method	*Variable stimulus; fixed, threshold performance.*	*Standardized task; variable performance or difficulty.*
Tests	*Single variable, under controlled conditions.*	*Multiple variable, under complex, real-life conditions.*
Criteria	*Threshold performance.*	*Sustainable, supra-threshold performance.*
Involves	*Visual parameters only.*	*May also reflect non-visual factors.*

Visual function and functional vision assessment

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- **Basic visual functions – Oculomotor functions**
  - **Visual interest sphere / working distance**: the areas within the visual field where children give the best visual feedback




Examples of materials and toys than can be used for establishing visual interest sphere / working distance in children with a suspicion of CVI

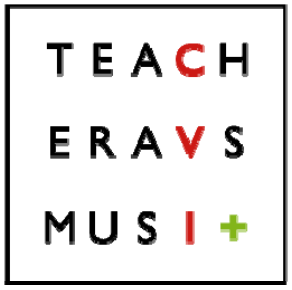
Visual function and functional vision assessment

- **Basic and middle visual functions: sensory functions – Overview**
  - Visual acuity
  - Visual field
  - Contrast sensitivity
  - Colour vision
  - Stereopsis
  - Visual adaptation
  - Motion perception
  - Role of sensorial visual functions and movement in daily life activities

Visual function and functional vision assessment

- **Relation between basic and middle visual functions and functional vision**
  - Role of oculomotor functions in daily life activities:
    - Selecting and detecting information within the environment
    - Fixate on objects, people or actions in different areas of the visual field
    - Following visual stimuli in movement in playing situations, detection of landmarks in orientation situations, both indoor and outdoor
    - Using eye contact in communication with people
    - Seeing objects clearly both near and in distance
    - Able to switch the eyes from one point to another – e.g. from one picture to another in order to find the target picture or from one text line to another when reading

Visual function and functional vision assessment



- **Relation between basic and middle visual functions and functional vision**
  - Role of sensorial visual functions and movements in daily life activities:
    - Clearly seeing details about elements, pictures and text
    - Reading texts in different seizes and different backgrounds
    - Seeing details both near and at distance space
    - Moving freely in space by covering stimuli in different areas of the visual field
    - Noticing people in a group, making difference among stimuli within environment in different levels of contrast

Visual function and functional vision assessment

- **Higher visual functions – visual perception**
  - Role of the higher visual functions in daily life activities:
    - Recognize, identify and discriminate objects – orientation – recognize landmarks like buildings, trees, pathways; reading – recognizing letters and words
    - Recognize and identify simultaneously multiple objects or people – finding a friend in a group of children in different spaces
    - Build words from different letters and give a meaning (writing and understanding the written text)

Visual function and functional vision assessment

- **Higher visual functions – visual perception**
  - Role of the higher visual functions in daily life activities:
    - Copying pictures, drawings, letters, words, text under the visual control
    - Recognizing people by their facial features and facial expressions – communication
    - Moving freely in space in a very busy scene and objects / people in movement

Final thoughts

Final thoughts

- Please note that provided information are not exhaustive
- This publication was supported by the Erasmus+ Programme of the European Commission
- This publication reflects the views of the authors, partners of the TeachCVI projects. Therefore, the Commission cannot be held responsible for any use of the information contained herein
- Find more information about the TeachCVI project on the website: http://www.teachcvi.net
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